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Product Information

ISSUE DATE : 00-04-01
MODEL : LTM240W1-L01

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PREPARED BY : AMLCD Application Engineering Group

SAMSUNG ELECTRONICS CO., LTD.

SAMSUNG TFT-LCD ELECTRONICS

Doc. No : PI003

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CONTENTS

General Description ---------- (3)

1. Electrical Absolute Characteristics ---------- (4)
   1.1 TFT LCD Module
   1.2 Back-light Unit

2. Optical Characteristics ---------- (5)

3. Electrical Characteristics ---------- (8)
   3.1 TFT LCD Module
   3.2 Back-light Unit

4. Block Diagram ---------- (11)
   4.1 TFT LCD Module
   4.2 Back-light Unit

5. Input Terminal Pin Assignment ---------- (12)
   5.1 Input signal & Power
   5.2 Back-light Unit
   5.3 Input Signal,Basic Display Colors and Gray Scale of Each Colors

6. Interface Timing ---------- (15)
   6.1 Timing Parameters and Diagram(DE Only Mode)
   6.2 Power ON/OFF Sequence

7. Outline Dimension ---------- (17)

8. General Precautions ---------- (18)
   8.1 Handling
   8.2 Storage
   8.3 Operation
   8.4 Others

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GENERAL DESCRIPTION

DESCRIPTION

LTM240W1 is a color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching devices. This model is composed of a TFT LCD panel, a driver circuit and a back-light system. The resolution of a 24.0" contains 1920 x 1200 pixels and can display up to 16.7 million colors with wide viewing angle of 85° in all directions.

FEATURES

- High contrast ratio, High aperture structure
- PVA(Patterned Vertical Alignment) Mode
- Wide Viewing Angle
- High speed response
- WUXGA(1920x1200 pixels) resolution
- Low power consumption
- 6 CCFTs(Cold Cathode Fluorescent Tube)
- DE Only Mode
- Open LDI(DS90CF388)

APPLICATIONS

- Workstation & High end Desktop monitors
- Display terminals for AV application products
- Monitors for Industrial machine
- HDTV

General Information

ITEM	SPECIFICATION	UNIT	NOTE
Display area	518.4(H) x324(V) (24.06 inch diagonal)	mm	
Driver element	a-si TFT active matrix		
Display colors	16.7M (True 8-bit)		
Number of pixel	1920 x 1200	pixel	
Pixel arrangement	RGB vertical stripe		
Pixel pitch	0.27(H) x 0.27(V)	mm	
Display Mode	Normally Black		
Surface treatment	Haze 12 , Hard - Coating (3H)		

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Mechanical Information

ITEM		MIN.	TYP.	MAX.	NOTE
Module size	Horizontal (H)	-	569.1	-	mm
	Vertical (V)	-	368.4	-	mm
	Depth (D)	-	-	32	mm
Weight (W/O inverter)		-	-	(5,600)	g

1. ELECTRICAL ABSOLUTE RATINGS

1.1 TFT LCD MODULE

(Vss =GND= 0 V)

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Power Supply Voltage	V_{DD}	Vss-0.5	(6.0)	V	(1)

NOTE (1) Within Ta (25 ± 2 ^{O}C)

1.2 BACK-LIGHT UNIT

Ta = 25 ± 2 ^{O}C

ITEM	SYMBOL	MIN.	MAX.	UNIT.	NOTE
Lamp current	I_L	(3.0)	(8.0)	mA_{rms}	(1)
Lamp frequency	f_{L1}	(30)	(60)	KHz	(1)

NOTE (1) Permanent damage to the device may occur if maximum values are exceeded. Functional operation should be restricted to the conditions described under Normal Operating Conditions.

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2. OPTICAL CHARACTERISTICS

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note (4).
Measuring equipment : TOPCON BM-5A, BM-5A
PHOTO RESEARCH PR650

* Ta = 25±2°C , V_{DD} = 5.0V, fv= 60Hz, f_{DCLK}=97.5MHz, I_L = 6.5 mArms

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Contrast Ratio (Center of screen)		CR		(400)		-		(1), (2), (4)
Response Time at Ta	Rising	T_R		-	(15)	-	msec	(1), (3)
	Falling	T_F		-	(20)	-		
Luminance of White (Center of screen)		Y_L			270	-	cd/m^2	(1), (4)
Color Chromaticity (CIE)	Red	R_X	ϕ = 0, θ = 0 Normal Viewing Angle	-	0.610	-		(1), (4)
		R_Y		-	0.356	-		
	Green	G_X		-	0.313	-		
		G_Y		-	0.584	-		
	Blue	B_X		-	0.149	-		
		B_Y		-	0.137	-		
	White	W_X		-	(0.315)	-		
		W_Y		-	(0.350)	-		
Viewing Angle	Hor.	θ_L	CR ≥ 10	-	85	-	Degrees	
		θ_R		-	85	-		
	Ver.	ϕ_H		-	85	-		
		ϕ_L		-	85	-		

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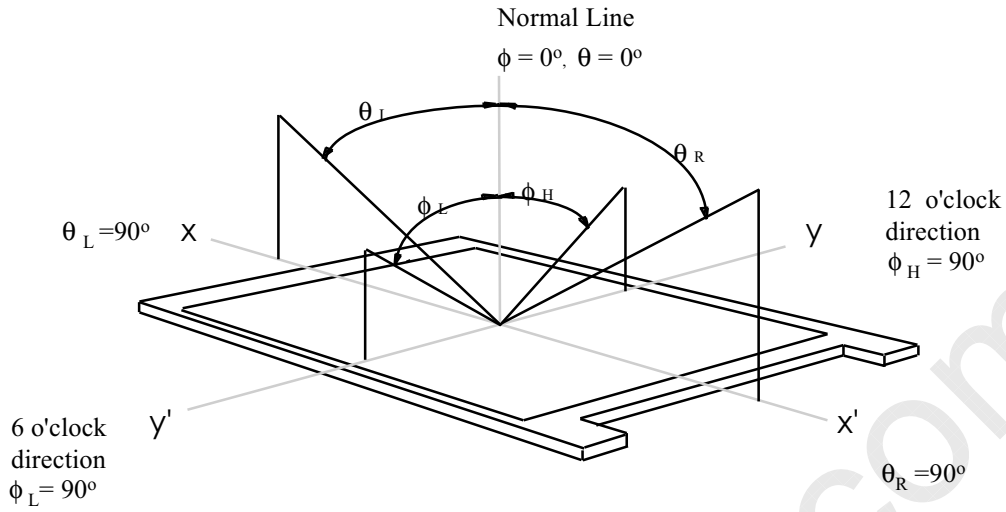
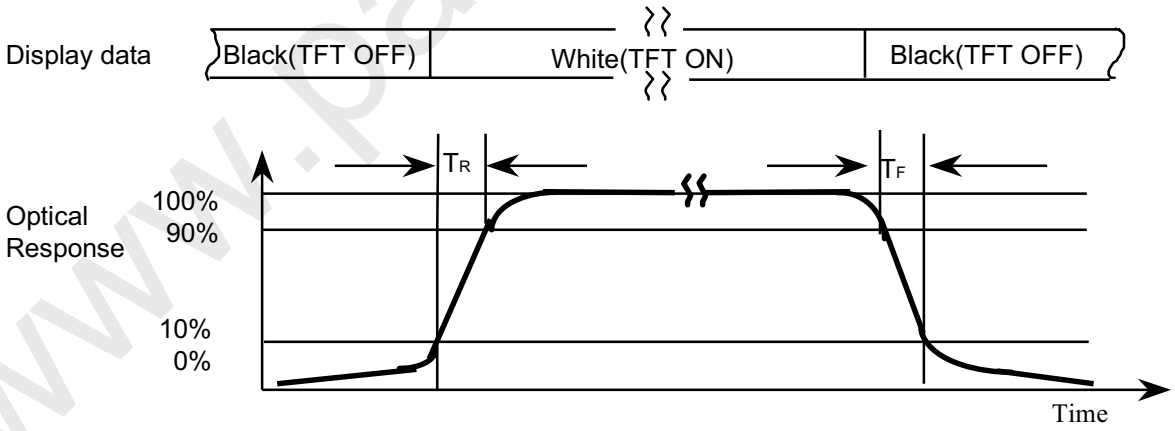
Note 1) Definition of Viewing Angle : Viewing angle range (10≤ CR)



Note 2) Definition of Contrast Ratio (CR) : Ratio of gray max (Gmax) ,gray min (Gmin) at the center of the screen

$$CR = \frac{\text{Luminance with all pixels white (Gmax)}}{\text{Luminance with all pixels black (Gmin)}}$$

Note 3) Definition of Response time : Sum of T_R ,T_F



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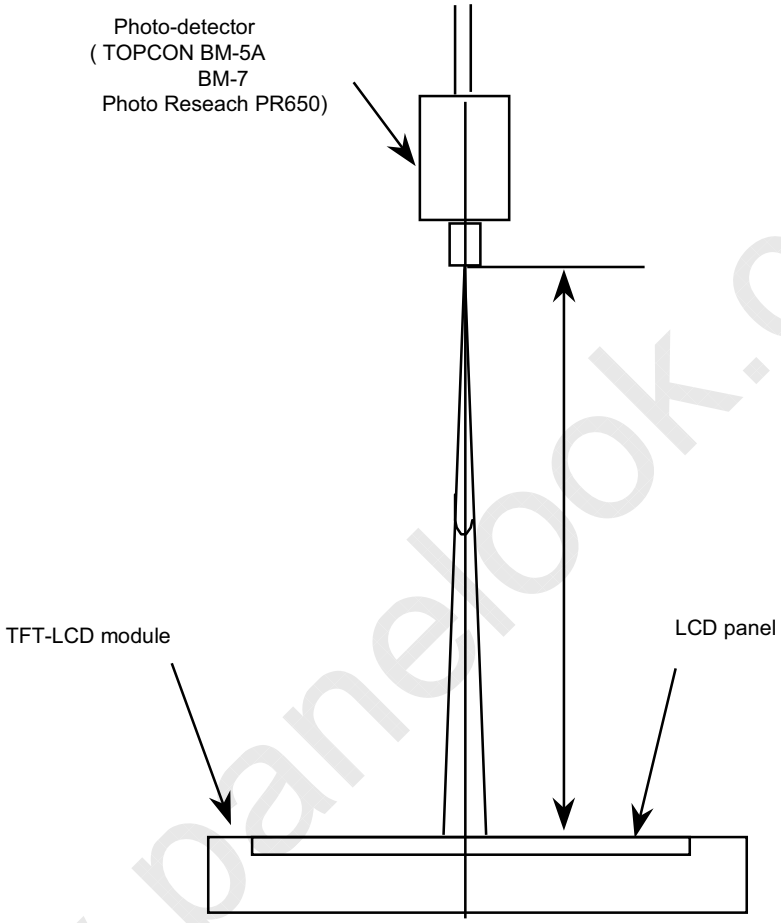
Note 4) After stabilizing and leaving the panel alone at a given temperature for 30 min , the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. 30 min after lighting the back-light. This should be measured in the center of screen.
Each lamp current :6.5mA (Refer to the note(1) in the page 10 for more information.)
Environment condition : Ta = 25°C ± 2 °C



Optical characteristics measurement setup

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3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE

Ta= 25 ± 2 °C

ITEM		SYMBOL	MIN	TYP	MAX	UNIT	NOTE
Voltage of Power Supply		V_{DD}	4.5	5.0	5.5	V	
Current of Power Supply	Black	I_{DD}	-		-	mA	(1)(3)*a
	Mosaic		-		-	mA	(1)(3)*b
	White		-	(1800)	(2,100)	mA	(1)(3)*c
Vsync Frequency		fV	-	60	-	Hz	
Hsync Frequency		fH	-	75	-	kHz	
Main Frequency		fDCLK	-	97.5	-	MHz	(2)
Rush Current		Irush	-	-	(6.0)	A	(4)

Note (1) f_V=60Hz, f_{DCLK} =97.5MHZ, V_{DD} = 5.0V, DC Current.

(2) Main pixel clock frequency is the value which is measured at the input of Timing controller.

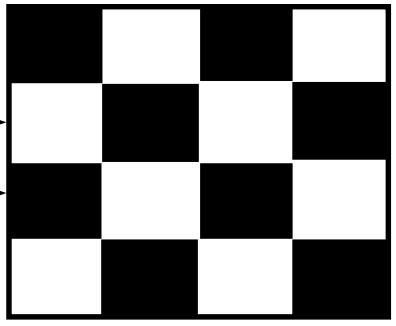
(3) Power dissipation check pattern(LCD Module only)

*a) Black Pattern

Display Brightest Gray Level

Display Darkest Gray Level

*b) Mosaic Pattern



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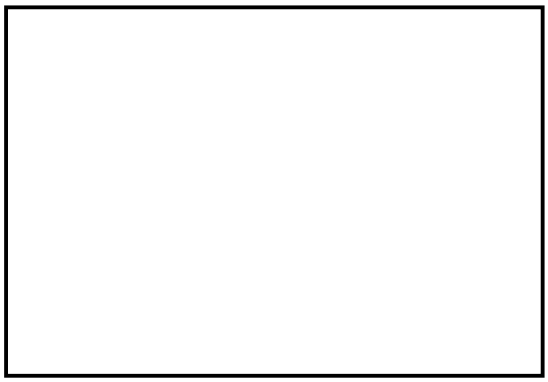
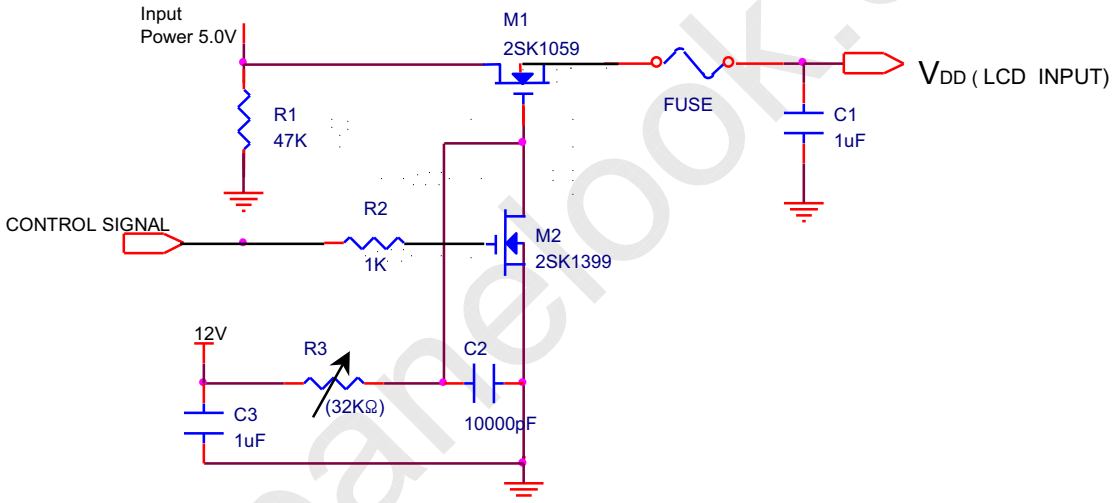
*c) White



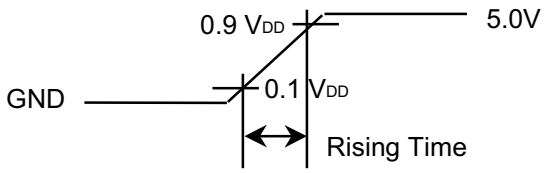
(4) Measurement Conditions



Note : Control Signal : High(+5.0V) -->Low(Ground)

All Signal lines to panel except for power 5.0V : Ground

The rising time of supplied voltage is controlled to 470us by R3 and C2 value.



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3.2 BACK-LIGHT UNIT

The back-light system is an edge-lighting type with 6 CCFTs(Cold Cathode Fluorescent Tube).

The characteristics of each lamp is shown in the following tables.

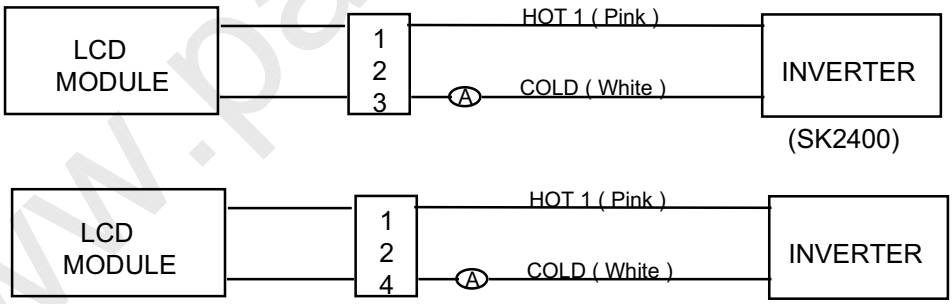
Ta=25±2°C

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	NOTE
Lamp Current	I_L	(6.2)	(6.5)	(6.8)	mA rms	(1)
Lamp Voltage	V_L	-	(900)	-	Vrms	
Lamp Frequency	f_L	(30)	-	(60)	kHz	(2)
Operating Life Time	Hr	(45.000)	-	-	Hour	(3)
Startup Voltage	Vs	-	-	(1700)(25 °C) (1900) (0 °C)	Vrms	(4)

Note) The method of measurement's inverter should be used PWM(Pulse Width Modulation). The waveform of the inverter output voltage must be area symmetric and the design of the inverter must have specifications for the modularized lamp.

The performance of the back-light, for example life time or brightness, is much influenced by the characteristics of the DC-AC inverter for the lamp. So all the parameters of an inverter should be carefully designed so as not to produce too much leakage current from high-voltage output of the inverter. When you design or order the inverter, please make sure that a poor lighting caused by the mismatch of the back-light and the inverter(miss lighting, flicker, etc.) never occur. When you confirm it, the module should be operated in the same condition as it is installed in your instrument.

Note (1) Lamp current is measured with current meter for high frequency as shown below.
Refer to the block diagram of the back-light unit in the next page for more information.
Specified values are for each lamp.



(2) Lamp frequency may produce interference with horizontal synchronous frequency and this may cause line flow on the display. Therefore lamp frequency shall be detached from the horizontal synchronous frequency and its harmonics as far as possible in order to avoid interference.

(3) Life time (Hr) of a lamp is defined as the time in which it continues to operate under the condition of Ta=25±2°C and I_L = 6.5mArms for each lamp until the brightness becomes 50% or lower than it's original value.

(4) The voltage above this value should be applied to the lamps for more than 1 second to startup. Otherwise the lamps may not to be turned on.

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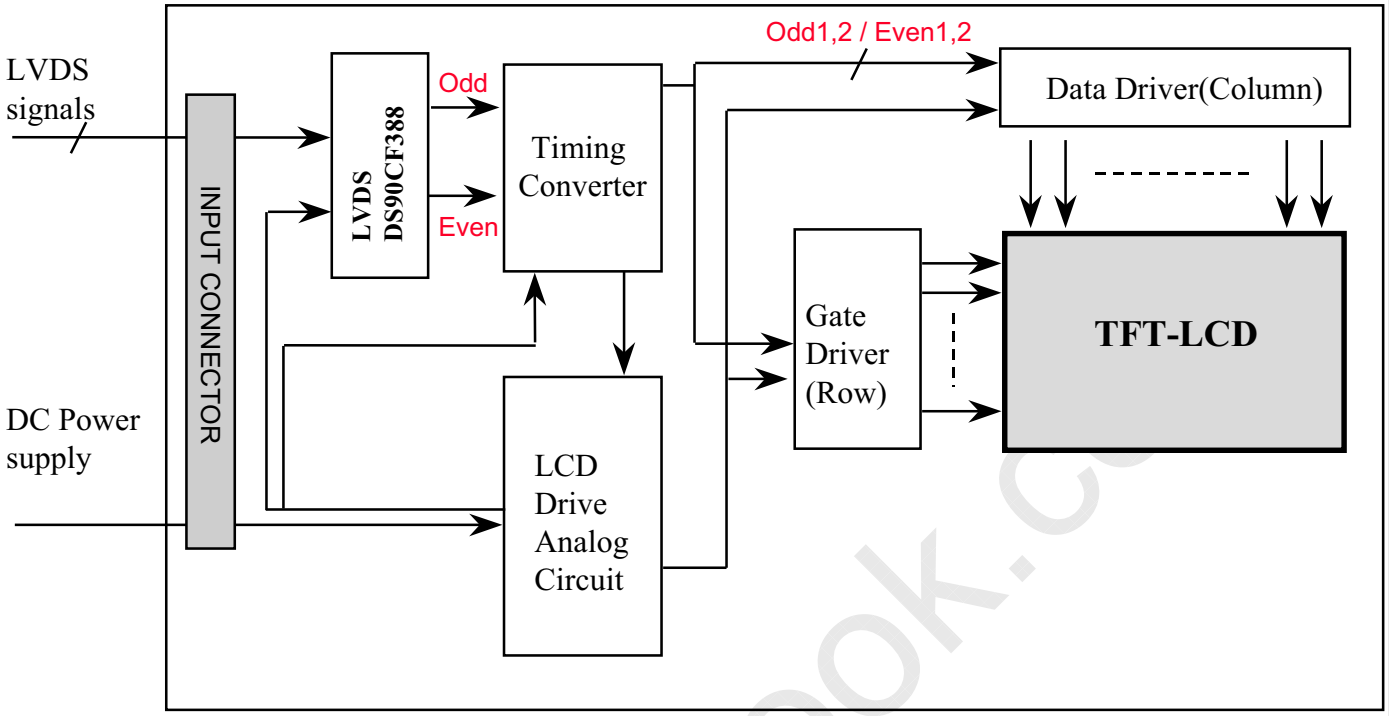
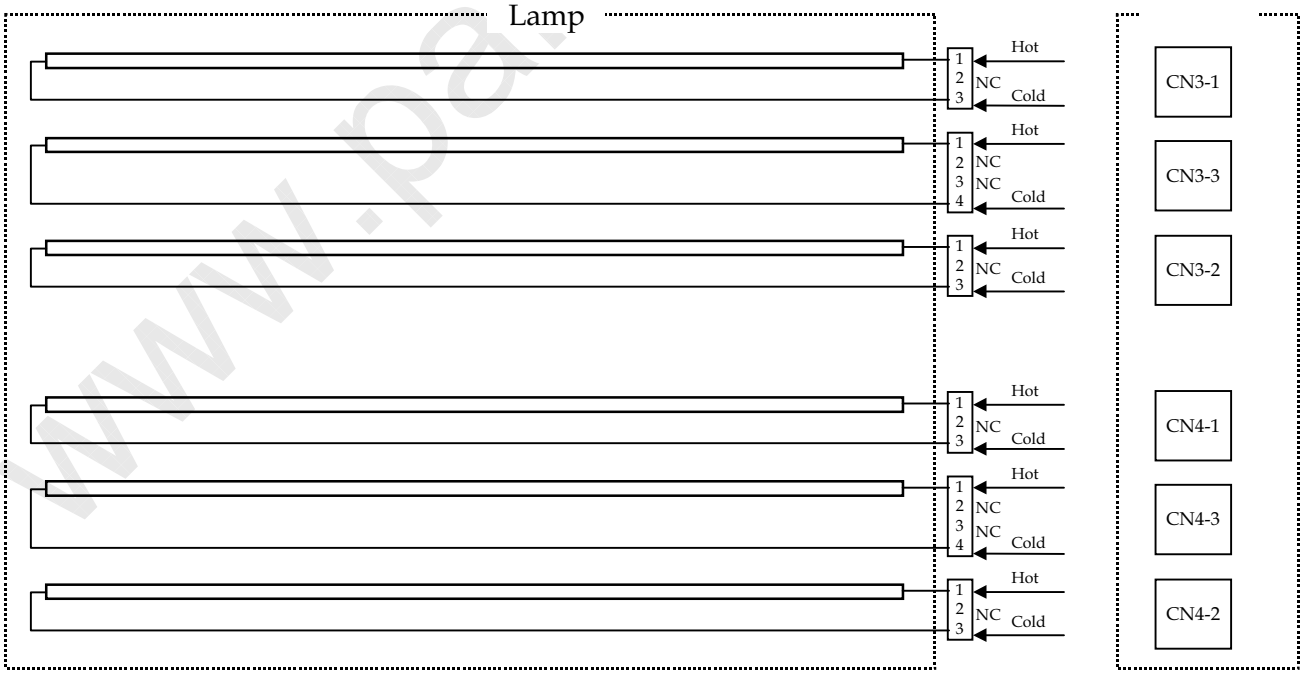
4. BLOCK DIAGRAM

4.1 TFT LCD MODULE



4.2 BACK-LIGHT UNIT



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5. INPUT TERMINAL PIN ASSIGNMENT

5.1. Input Signal (Connector : JAE F1-WE31P-HF)
(Mating Connector :JAE F1-WE31S-HF)

387 No.	Tx Signal	JAE31P No.	388 No.	Rx Signal	Remark
		31 (Reserved)		Reserved	Service Port
		30 (Reserved)		Reserved	Service Port
		29 (Reserved)		Reserved	Service Port
		28 (Reserved)		Reserved	Service Port
		27 (Reserved)		Reserved	Service Port
28	TxOut7+	26	79	RxOut7+	Twisted Pair
29	TxOut7-	25	80	RxOut7-	
		24 (GND)			Twisted Pair
		23 (GND)			
31	TxOut6+	22	82	RxOut6+	Twisted Pair
32	TxOut6-	21	83	RxOut6-	
33	TxOut5+	20	84	RxOut5+	Twisted Pair
34	TxOut5-	19	85	RxOut5-	
36	TxOut4+	18	86	RxOut4+	Twisted Pair
37	TxOut4-	17	87	RxOut4-	
		16 (GND)			Twisted Pair
		15 (GND)			
38	TxOut3+	14	89	RxOut3+	Twisted Pair
39	TxOut3-	13	90	RxOut3-	
41	TxOutCLK+	12	91	RxOutCLK+	Twisted Pair
42	TxOutCLK-	11	92	RxOutCLK-	
		10 (GND)			Twisted Pair
		9 (GND)			
44	TxOut2+	8	94	RxOut2+	Twisted Pair
45	TxOut2-	7	95	RxOut2-	
46	TxOut1+	6	96	RxOut1+	Twisted Pair
47	TxOut1-	5	97	RxOut1-	
49	TxOut0+	4	98	RxOut0+	Twisted Pair
50	TxOut0-	3	99	RxOut0-	
		2 (GND)			Twisted Pair
		1 (GND)			

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5.2. Input Power (Connector : Molex 53261-1290)
(Mating Connector : Molex 51021-1200)

Pin No	Symbol	Function
1	+5V	Power Supply +5V
2		
3		
4		
5		
6		
7	GND	Power Ground
8		
9		
10		
11		
12		

5.3 BACK-LIGHT UNIT

PIN No.	INPUT [ch1] , [ch2]	Color	Function
3-1-1	HOT	Pink	High Voltage
3-1-2	N.C.	-	-
3-1-3	Cold	White	Ground
3-2-1	HOT	Pink	High Voltage
3-2-2	N.C.	-	-
3-2-3	Cold	White	Ground
3-3-1	HOT	Pink	High Voltage
3-3-2	N.C.	-	-
3-3-3			
3-3-4	Cold	White	Ground
	HOT	Pink	High Voltage
	N.C.	-	-
	Cold	White	Ground
	HOT	Pink	High Voltage
	N.C.	-	-
	Cold	White	Ground
	HOT	Pink	High Voltage
	N.C.	-	-
Connector Part No.	JST BHR-03VS-1, JST BHR-04VS-1		

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5.4 Input Signal,Basic Display Colors and Gray Scale of Each Colors

COLOR	DISPLAY	DATA SIGNAL																								GRAY SCALE LEVEL
		RED								GREEN								BLUE								
		R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7	
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	-
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	-
	CYAN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-
	RED	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
	MAGENTA	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	-
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	-
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-
GRAY SCALE OF RED	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R0
	DARK	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R1
	↑	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	R3~R252
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	↓	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R253
	LIGHT	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R254
	RED	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R255
GRAY SCALE OF GREEN	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G0
	DARK	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G1
	↑	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	G3~G252
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	↓	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G253
	LIGHT	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G254
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G255
GRAY SCALE OF BLUE	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	B0
	DARK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	B1
	↑	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	B2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	B3~B252
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	↓	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	B253
	LIGHT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	B254
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	B255

Note) ▸ Definition of Gray :

Rn : Red Gray, Gn : Green Gray, Bn : Blue Gray (n = Gray level)

▸ Input Signal : 0 = Low level voltage, 1 = High level voltage

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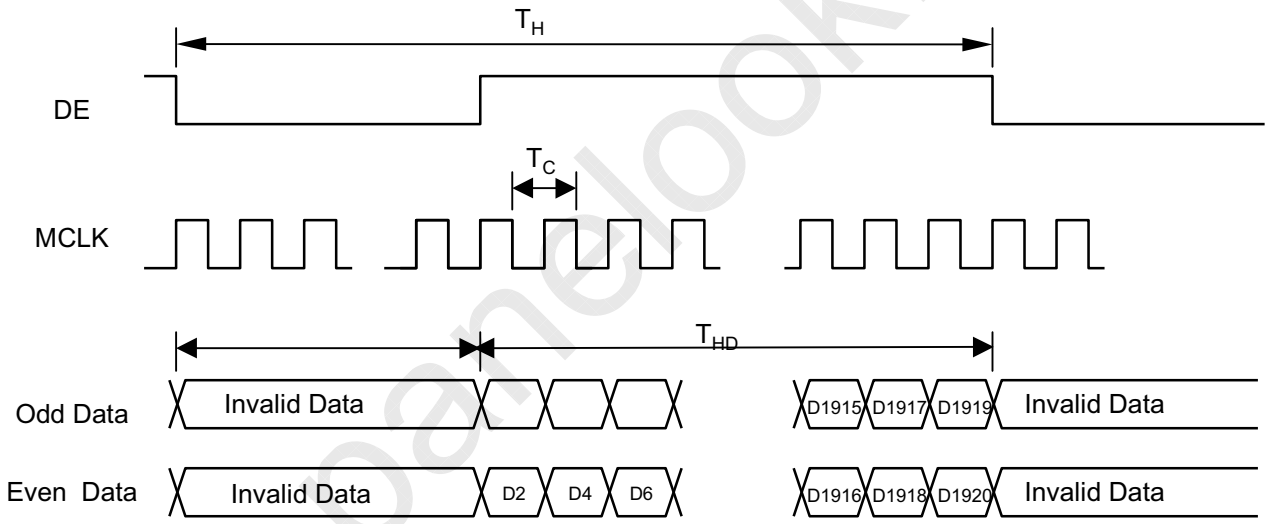
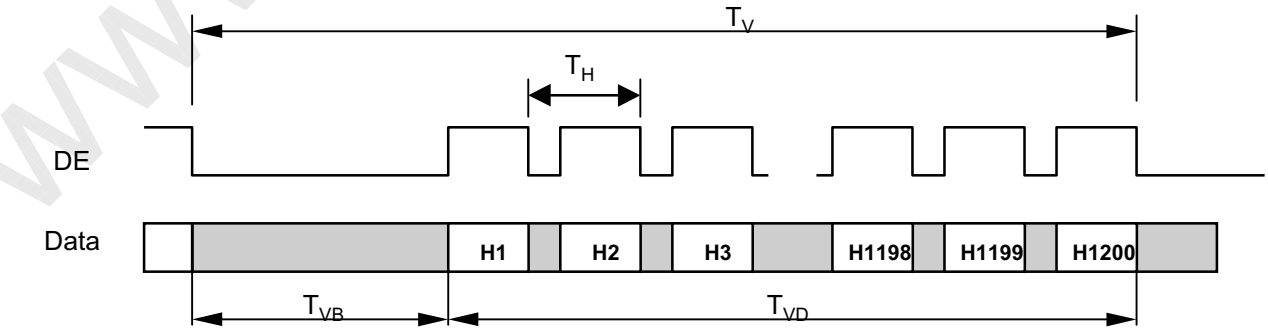
6.1 Timing Parameters and diagram of Interface signal (DE Only Mode)

Item		Symbol	Min	Typ	Max	Unit
Clock Frequency		1/Tc	76.5	97.5	97.5	MHz
Horizontal	Total Period	T_H	1056	1300	1300	Pixels
	Active Period	T_{HD}	960	960	960	Pixels
	Blank Period	T_{HB}	96	340	340	Pixels
Vertical	Total Period	T_V	1208	1250	1250	Lines
	Active Period	T_{VD}	1200	1200	1200	Lines
	Blank Period	T_{VB}	8	-	50	Lines

[Horizontal Timing]



[Vertical Timing]



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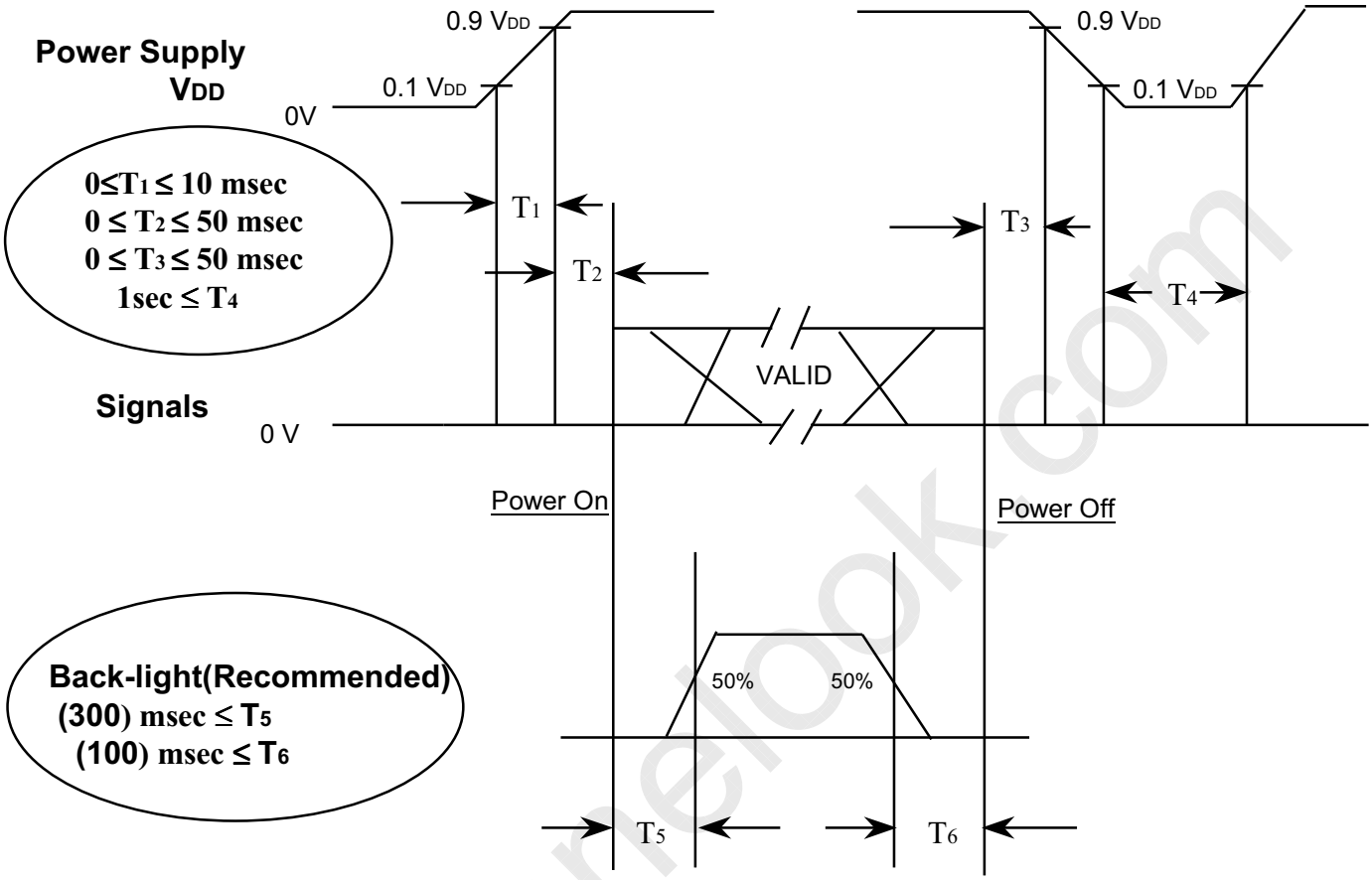
6.2 Power ON/OFF Sequence

: To prevent a latch-up or DC operation of the LCD module, the power on/off sequence should be as the diagram below.



Power ON/OFF Sequence

NOTE.

(1) The supply voltage of the external system for the module input should be the same as the definition of VDD.

(2) Apply the lamp voltage within the LCD operation range. When the back-light turns on before the LCD operation or the LCD turns off before the back-light turns off, the display may momentarily become white.

(3) In case of VDD = off level, please keep the level of input signals on the low or keep a high impedance.

(4) T4 should be measured after the module has been fully discharged between power off and on period.

(5) Interface signal shall not be kept at high impedance when the power is on.

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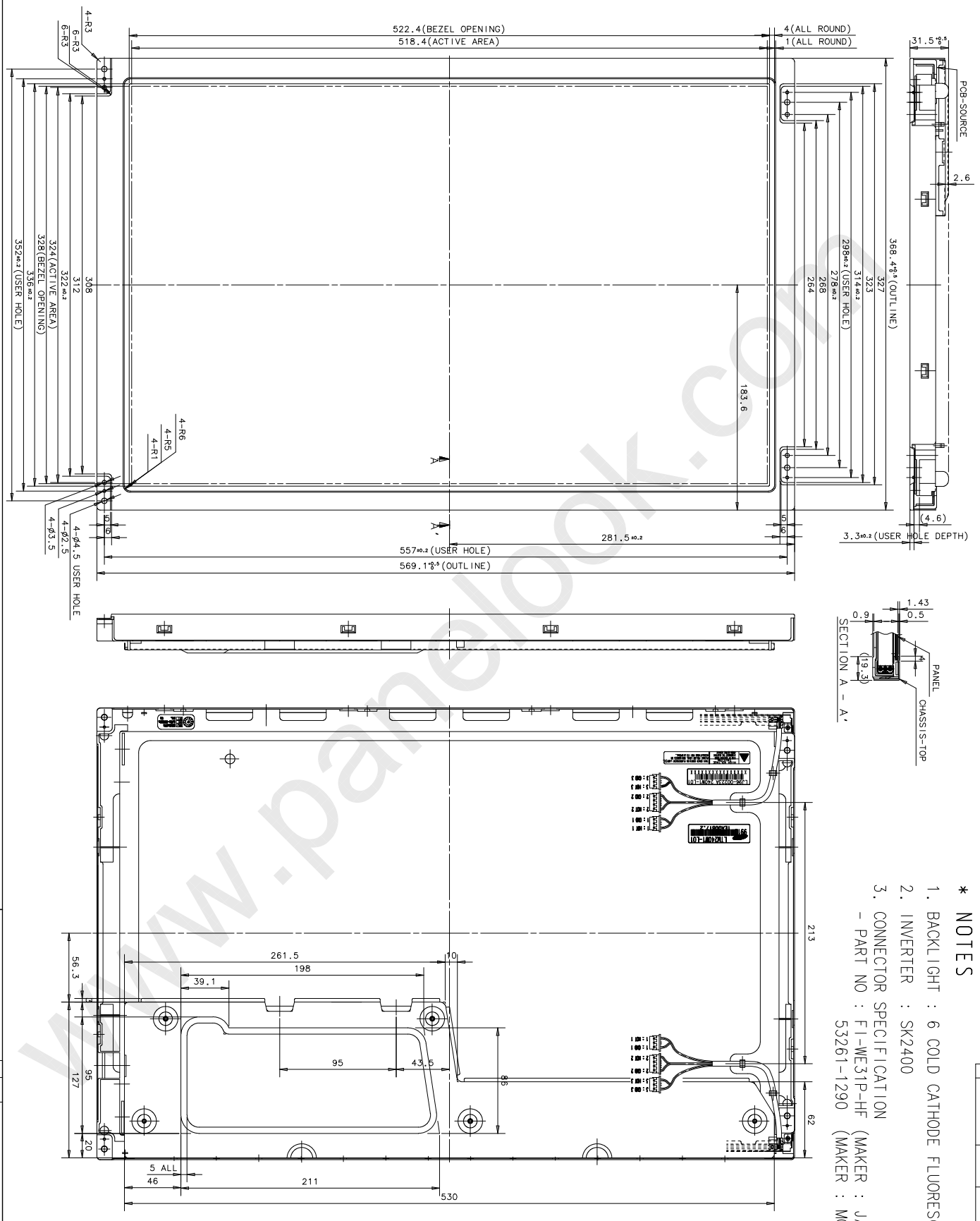

* NOTES

1. BACKLIGHT : 6 COLD CATHODE FLUORESCENT LAMPS
2. INVERTER : SK2400
3. CONNECTOR SPECIFICATION
   - PART NO : FI-WE31P-HF (MAKER : JAE)
     53261-1290 (MAKER : MOLEX)

GENERAL TOLERANCE			
STEP	LEVEL 1	LEVEL 2	LEVEL 3
0 < X ≤ 4	±0.05	±0.1	±0.2
4 < X ≤ 16	±0.08	±0.15	±0.3
16 < X ≤ 64	±0.12	±0.25	±0.5
64 < X ≤ 256	±0.25	±0.4	±0.8

REV	DATE	DESCRIPTION OF REVISION	DRAWN BY	DES'D BY	CHK'D BY	APP'D BY
			SCALE 1/1 UNIT mm	C.H.CHO	99.9.10	J.D.PARK

SAMSUNG ELECTRONICS

CODE NO.	PART/SHEET NAME: OUTLINE DEMENSION SHEET
	MODEL NAME: LTM240W1
	SPEC. NO: 99.12.20
	REASON
VER.	CHG'D BY

NO	PART NAME	CODE NO	SPECIFICATION	Q'TY	WEIGHT	UNSPECIFIED TOL OF MATERIAL	REMARK
					FINISH MATERIAL		

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